UROP Work Summary Report 1

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Program: Unified Research Opportunity Program (UROP)
Project Title: *AI-Driven Approaches for Carbon Footprint Reduction in Supply Chain Management*
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Project Overview

The UROP project titled *"AI-Driven Approaches for Carbon Footprint Reduction in Supply Chain Management"* focuses on exploring the application of artificial intelligence and machine learning techniques to enhance sustainability in modern supply chain systems. With supply chains becoming increasingly complex, global, and resource-intensive, they contribute significantly to greenhouse gas emissions. This research aims to investigate intelligent, data-driven methods that can help optimize supply chain operations while reducing their environmental impact.

Primary Objective

The primary objective of this project is to study and develop AI-driven approaches that reduce the carbon footprint in supply chain management. The research focuses on leveraging machine learning, predictive analytics, and optimisation techniques to improve key supply chain functions such as demand forecasting, transportation planning, inventory management, warehousing, and supplier selection, with sustainability as a core priority.

Work Carried Out

As part of this research project, my primary contribution has been conducting an in-depth **literature review** to build a strong theoretical and conceptual foundation for the study. I have thoroughly read and analysed **six research papers** published in reputed journals and conferences related to:

- AI and machine learning applications in supply chain management
- Carbon footprint measurement and reduction strategies
- Predictive analytics for demand forecasting
- Optimisation of transportation routes and logistics to minimise fuel consumption
- Sustainable supplier selection using data-driven approaches

The literature review involved understanding existing methodologies, identifying commonly used AI models, analysing sustainability metrics, and comparing different optimisation techniques

proposed by researchers. Special attention was given to how predictive and prescriptive analytics can reduce overproduction, excess inventory, unnecessary transportation, and inefficient logistics operations.

Key Learnings and Insights

Through this literature study, I gained insights into how AI-driven demand forecasting can significantly reduce waste and emissions by aligning production with actual market demand. I also studied optimisation techniques used for route planning, load management, and the selection of low-emission transportation modes. Additionally, the review highlighted the growing importance of AI-based supplier sustainability assessment to promote responsible procurement and greener sourcing decisions.

Conclusion

The work completed so far has provided a strong understanding of the current research landscape in AI-enabled sustainable supply chain management. The literature review has helped identify research gaps and potential directions for developing intelligent, carbon-conscious supply chain models. This foundational work will support further research and implementation of AI-driven solutions aimed at building eco-efficient, resilient, and sustainable supply chains aligned with global climate goals.

Literature Review Document:
literature Review UROP